

### **Delta and Longfin Smelt Bioenergetics: Determining Maximum Consumption**

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**Abstract:** Delta and Longfin smelt abundance in the San Francisco Estuary has declined dramatically since the 1980s. Individual-based population life-cycle models (IBMs) were developed for both species to explore the population response to various environmental and management scenarios. However, key data gaps exist for the bioenergetics (growth) components of both IBMs, necessitating laboratory studies to determine the quantity of food consumed by delta and Longfin smelt. The objectives of the first part of this study were to create rearing conditions required to study the temperature-dependent food consumption by various life stages of smelt, and to develop a methodology to estimate the daily food consumption. An aquaculture facility, consisting of three independent recirculating systems with four tanks each, was constructed and tested. Cultured juvenile and adult delta smelt were used to develop methods to assess diel feeding patterns and gastric evacuation times and rates. Adult and juvenile delta smelt were successfully maintained in the new aquaculture facility. Three experimental groups of adult fish were held simultaneously at water temperatures of 9, 13 and 17°C. Stomach contents from juvenile and adult delta smelt were successfully retrieved by dissection. Both smelt life stages fed actively during multiple feeding events throughout the day, but no consumption occurred during nighttime hours. Gastric evacuation of juvenile and adult delta smelt after satiation feeding was completed after approximately 21 and 28 hours, respectively, and an exponential model was the best fit to describe gastric evacuation over time. Application of a feeding model indicated that daily consumption by adult delta smelt at a water temperature of 10°C averages approximately 1% of the fish wet weight. Methods presented here will facilitate the establishment of temperature and size dependent consumption components of bioenergetics models for both species.

**Statement of Relevance:** This project is directly related to the IEP goals to investigate and evaluate the causes of the Pelagic Organism Decline (POD). This study was funded by the Bureau of Reclamation, with one of the deliverables being the presentation of findings at the IEP annual workshop.